

# Studies on hot-filament chemical vapor deposition grown graphene sheets

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## ABSTRACT

Graphene was grown on high purity Cu foils using hot-filament chemical vapor deposition method. The foils were kept directly below the tungsten filament and the whole assembly was kept inside a vacuum chamber. CH<sub>4</sub> and H<sub>2</sub> were used as precursor gases and were allowed to shower on a hot filament, which was kept at a predetermined temperature. The optimization of the process parameters such as gas flow rates, temperature, durations, etc. was done to grow single layer and multilayer graphene. The graphene was characterized using optical microscopy, field emission scanning electron microscopy and micro-Raman spectroscopy techniques. The graphene layers grown at different methane flow rates are shown in Figure 1. By varying the methane flow rates, graphene domains of different sizes and shapes were achieved and are clearly evident from Figures 1a-c. The curved white lines (Figure 1a) present in the FESEM micrographs correspond to Cu terraces. The graphene grown on Cu foils was successfully transferred to SiO<sub>2</sub> substrate and the micrograph of which is shown in Figure 1d. The presence of D, G and G' bands in the Raman spectrum confirmed the growth of graphene in the Cu foil (Figure 2).

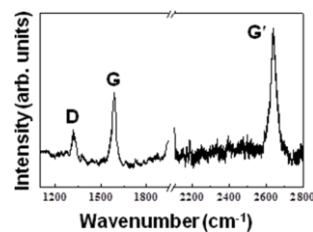
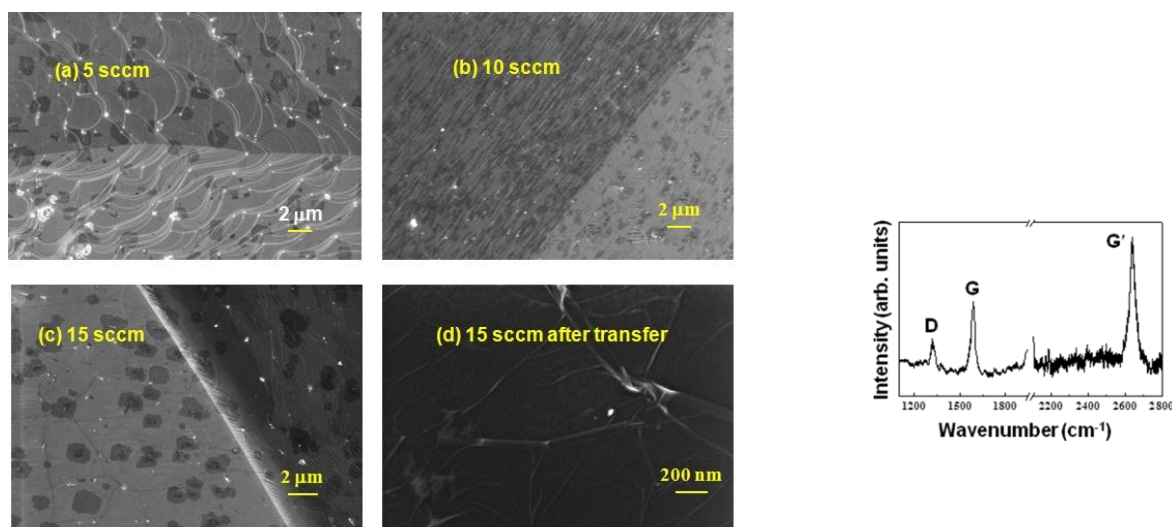


Figure 2. Raman spectrum of as-grown graphene on Cu foils.

Figure 1. FESEM micrographs of graphene grown on Cu foils at different methane flow rates (a) 5 sccm (b) 10 sccm (c) 15 sccm (d) transferred graphene on SiO<sub>2</sub> substrate.